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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/937,715	01/16/2002	Philip S Russell	124-892	7024
7590	12/19/2003		EXAMINER	
Nixon & Vanderhye			SONG, SARAH U	
8th Floor			ART UNIT	
1100 North Glebe Road			PAPER NUMBER	
Arlington, VA 22201-4714			2874	

DATE MAILED: 12/19/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No. 09/937,715	Applicant(s) RUSSELL ET AL.	
	Examiner Sarah Song	Art Unit 2874	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 15 September 2003.
 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-20,22-27 and 30 is/are pending in the application.
 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
 5) ☒ Claim(s) 20 and 22-27 is/are allowed.
 6) ☒ Claim(s) 1-19 and 30 is/are rejected.
 7) ☐ Claim(s) _____ is/are objected to.
 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
 10) ☒ The drawing(s) filed on 16 January 2002 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
 Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
 Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. §§ 119 and 120

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
 a) ☒ All b) ☐ Some * c) ☐ None of:
 1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☒ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
 * See the attached detailed Office action for a list of the certified copies not received.
 13) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application) since a specific reference was included in the first sentence of the specification or in an Application Data Sheet. 37 CFR 1.78.
 a) ☐ The translation of the foreign language provisional application has been received.
 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121 since a specific reference was included in the first sentence of the specification or in an Application Data Sheet. 37 CFR 1.78.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892) 4) ☐ Interview Summary (PTO-413) Paper No(s). _____
 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948) 5) ☐ Notice of Informal Patent Application (PTO-152)
 3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) 0603. 6) ☐ Other: _____

DETAILED ACTION

1. Applicant's communication filed on September 15, 2003 has been carefully studied by the Examiner. The arguments advanced therein, considered together with the amendments made to the claims, are persuasive and the rejections based upon prior art made of record in the previous Office Action are withdrawn. Claims 1, 10 and 30 have been amended. Claims 1-20, 22-27 and 30 are pending.

Information Disclosure Statement

2. The information disclosure statement filed June 17, 2003 fails to comply with 37 CFR 1.97(c) because it lacks a statement as specified in 37 CFR 1.97(e) and/or it lacks the fee set forth in 37 CFR 1.17(p). It has been placed in the application file, but the information referred to therein has not been considered.

Claim Objections

3. Claim 6 is objected to because of the following informalities: "the fraction of air" lacks proper antecedent basis. Appropriate correction is required.

Claim Rejections - 35 USC § 102

4. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

5. **Claims 1, 2, 5, 10 and 11 are rejected under 35 U.S.C. 102(e) as being anticipated by Fink et al. (U.S. Patent 6,463,200 newly cited).** Fink et al. discloses a photonic crystal fiber 600 comprising: a region 602 of substantially uniform, lower refractive index; said lower refractive index region 602 substantially surrounded by cladding which includes regions 604-616 of higher refractive index (see Figure 6B) and which is substantially periodic (the alternating layers of clad providing the periodicity), wherein the region of lower refractive index has a longest transverse dimension which is longer than a single, shortest period of the cladding (see Figures 6A and 6B), whereby light can be substantially confined in the lower refractive index region by virtue of a photonic band gap of the cladding material (inherent) and can be guided along the fiber whilst it is so confined (inherent). The region of lower refractive index comprises a gas, such as air (see column 7, line 33). Regarding claim 5, the regions of higher refractive index 606, 610 and 614 consist essentially of silica (i.e. glass, see Claim 10). Regarding claims 10 and 11, it is noted that the region 602 is large enough to support at least one transverse mode and that the fiber is a single mode fiber (see Claim 4).

6. **Claims 1, 2, 5-7 are rejected under 35 U.S.C. 102(e) as being anticipated by Borrelli et al. (previously cited).** Borrelli et al. discloses a photonic crystal fiber comprising: a region 58 of substantially uniform, lower refractive index; said lower refractive index region 58 substantially surrounded by cladding which includes regions 62 of higher refractive index and which is substantially periodic (the channels 60 providing the periodicity), wherein Figure 7 clearly shows that the region of lower refractive index has a longest transverse dimension which is longer than a single shortest period of the cladding, whereby light can be substantially confined in the lower refractive index region by virtue of a photonic band gap of the cladding

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material and can be guided along the fiber whilst it is so confined (inherent). Regarding claims 2 and 7, it is noted that region 58 comprises a gas, such as air (i.e. it is hollow, see column 8, line 65). The regions of higher refractive index consist essentially of silica (glass 62). From Figure 7, it is evident that the fraction of air (represented by circles 60) in the cladding is at least 15% by volume based on the volume of the cladding.

Claim Rejections - 35 USC § 103

7. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

8. **Claims 8, 9, 12-19 and 30 are rejected under 35 U.S.C. 103(a) as being unpatentable over Fink et al.** Fink et al. discloses the claimed invention, but does not specifically disclose the lower refractive index low pressure region, a lower refractive index region having a non-linear response, a lower refractive index region large enough to support at least one transverse mode, the various optical devices, or a method of transmitting light along the fiber by providing a light source.

9. Regarding claim 8, low-pressure regions such as vacuums are known in the art to have a similar refractive index as air and are known to propagate EM radiation in a comparable manner. Therefore, because these two were art-recognized equivalents at the time the invention was made, one of ordinary skill in the art would have found it obvious to substitute the air in the core region of Fink et al. with a low-pressure region.

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10. Regarding claim 9, materials having non-linear optical responses are well known in the art. Therefore, one of ordinary skill in the art would have found it obvious to provide the low-index region of Fink et al. having a non-linear optical response to provide utility as an optical amplifier, for example.

11. Regarding claims 12-19, it would have been obvious to one having ordinary skill in the art at the time the invention was made to provide the fiber of Fink et al. in any well known device that would benefit from the intrinsic low loss of the fiber (see column 8, lines 3-9). Spectral filter devices, amplifiers, lasers, sensors, telecommunications systems are all well known in the art. It would have been obvious to provide the photonic crystal fiber disclosed by Fink et al. in any of the above devices to resultantly reduce the intrinsic losses of each of the devices. Specifically regarding claim 16, the fiber of Fink et al is inherently "capable" of sensing a property of a gas in the core region due to the hollow core structure.

12. Regarding claim 30, it is common practice in the art to provide a light source adjacent an end of any fiber for transmitting light along the fiber. Therefore, since light is coupled into a photonic crystal fiber in the same manner as any other optical fiber, it would have been obvious to one having ordinary skill in the art to provide a light source adjacent an end of the fiber of Fink et al. and to arrange for light from the source to enter the fiber for transmission therethrough.

13. **Claims 3, 4, 8-19 and 30 are rejected under 35 U.S.C. 103(a) as being unpatentable over Borrelli et al.** Borrelli et al. discloses the claimed invention, including air holes in a solid cladding matrix, but does not specifically disclose a triangular lattice structure, the lower refractive index low pressure region, a lower refractive index region having a non-linear

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response, a lower refractive index region large enough to support at least one transverse mode, the various optical devices, or a method of transmitting light along the fiber by providing a light source.

14. Regarding claims 3 and 4, triangular lattice structures are well known in the art. One of ordinary skill in the art would have found it obvious at the time of the invention to provide a triangular lattice structure instead of the rectangular lattice structure of Borrelli et al. since the criticality of the device does not lie in the particular type of periodic lattice structure, but merely on the presence of a periodic lattice structure. Furthermore, one of ordinary skill in the art would have been motivated to provide a triangular lattice structure to equalize the spacing in all directions between the periodic channels (represented by circles 60).

15. Regarding claim 8, low-pressure regions such as vacuums are known in the art to have a similar refractive index as air and are known to propagate EM radiation in a comparable manner. Therefore, because these two were art-recognized equivalents at the time the invention was made, one of ordinary skill in the art would have found it obvious to substitute the air in the core region of Borrelli et al. with a low-pressure region.

16. Regarding claim 9, materials having non-linear optical responses are well known in the art. Therefore, one of ordinary skill in the art would have found it obvious to provide the low-index region of Borrelli et al. having a non-linear optical response to provide utility as an optical amplifier, for example.

17. Regarding claims 10, Borrelli et al. shows a similar fiber in Figure 6 that comprises a core that is large enough to propagate at least one transverse mode (i.e. a single mode fiber). Therefore, it would also have been obvious to one having ordinary skill in the art at the time the

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invention was made to provide the region of lower refractive index in the fiber of Figure 7 such that it is large enough to also support at least one transverse mode or a single mode to provide sufficient transmission of an optical signal therethrough without significant losses.

18. Regarding claims 12-19, it would have been obvious to one having ordinary skill in the art at the time the invention was made to provide the fiber of Borelli et al. in any well known device that would benefit from the intrinsic low loss of the fiber. Spectral filter devices, amplifiers, lasers, sensors, telecommunications systems are all well known in the art. It would have been obvious to provide the photonic crystal fiber disclosed by Borrelli et al. in any of the above devices to resultantly reduce the intrinsic losses of each of the devices. Specifically regarding claim 16, the fiber of Borrelli et al is inherently "capable" of sensing a property of a gas in the core region due to the hollow core structure.

19. Regarding claim 30, it is common practice in the art to provide a light source adjacent an end of any fiber for transmitting light along the fiber. Therefore, since light is coupled into a photonic crystal fiber in the same manner as any other optical fiber, it would have been obvious to one having ordinary skill in the art to provide a light source adjacent an end of the fiber of Borrelli et al. and to arrange for light from the source to enter the fiber for transmission therethrough.

Allowable Subject Matter

20. Claims 20 and 22-27 allowed for the reasons stated in the previous Office Action.

Response to Arguments

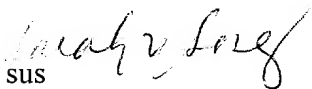
21. Applicant's arguments with respect to claims 1-19 and 30 have been considered but are moot in view of the new ground(s) of rejection.

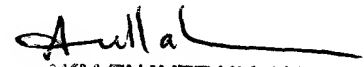
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Conclusion

22. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Cryan et al. and Hasegawa et al. disclose various low index core photonic crystal fibers, but do not qualify as prior art.

23. Any inquiry concerning the merits of this communication should be directed to Examiner Sarah Song at telephone number 703-306-5799. Any inquiry of a general or clerical nature, or relating to the status of this application or proceeding should be directed to the receptionist at telephone number 703-308-0956 or to the technical support staff supervisor at telephone number 703-308-3072.


sus


AKM ENAYET ULLAH
PRIMARY EXAMINER